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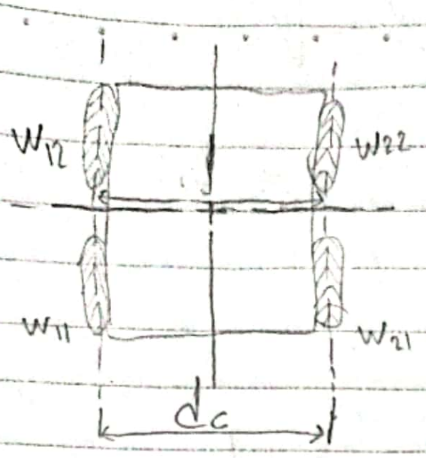
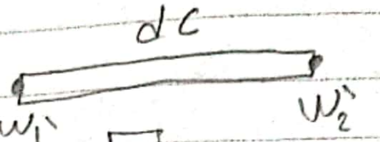




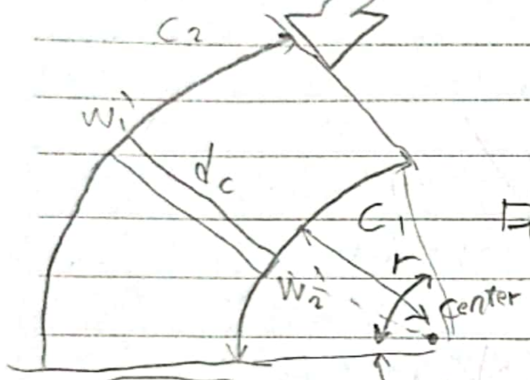


Fig 1

we can get circumference 1 & 2 ~~us~~ (C_1, C_2) using the encode signal

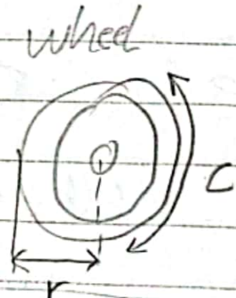
if we have (n) equally spaced holes in the disk then (n) signals will count as 1 rotatio

$$C = \theta_F \, r_{wheel}$$

Coming to Fig 1

$$C_1 = r\,\theta_F$$

$$C_2 = (r + d_c)\,\theta_F$$



$$C = r\,\theta_{rad}$$

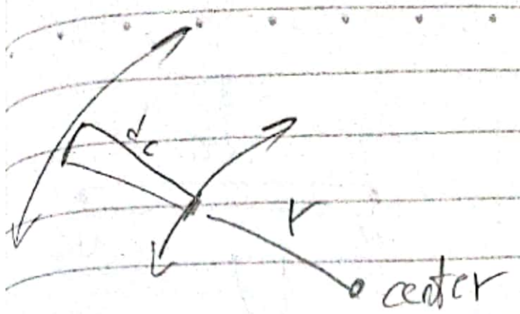
$$\hookrightarrow \boxed{C = r\,\frac{n}{N} \times 2\pi}$$

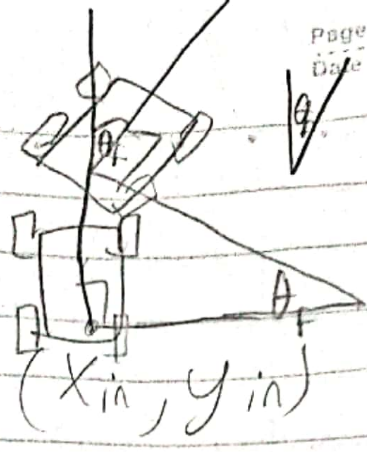
where (n) is number of signals and (N) is number of holes per desK

$$[r_1 - r_2 = d_c]$$

$$\frac{C_2}{C_1} = \frac{r + d_c}{r} \Rightarrow r\frac{C_2}{C_1} = r + d_c$$

$$r\left(\frac{C_2}{C_1} - 1\right) = d_c \Rightarrow \boxed{r} = \frac{d_c}{\left(\frac{C_2}{C_1}\right) - 1}$$





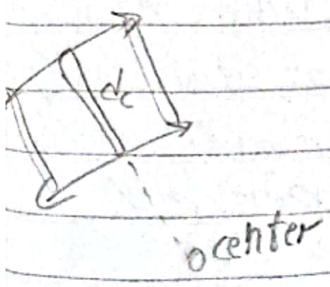
$$r = \frac{d_c}{\frac{c_2}{c_1} - 1} \qquad \theta_f = \frac{c_2 - c_1}{d_c}$$

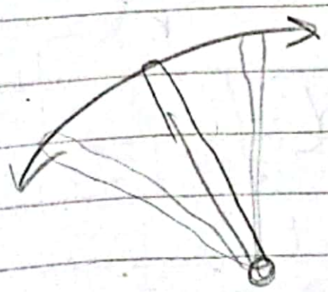
$$\theta_{robot} = (\theta_{initial} + \theta_f)^\circ \, \% \, 360$$

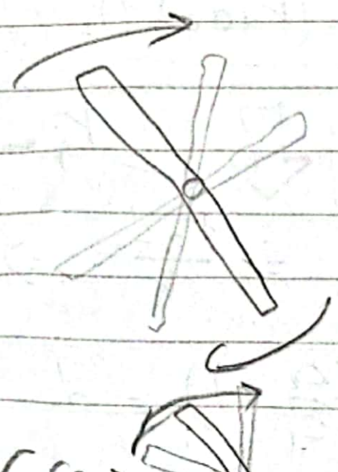
$$X_{robot} = X_{in} + \left(r + \frac{d_c}{2}\right)\cos(\theta)$$

$$y_{robot} = y_{in} + \left(r + \frac{d_c}{2}\right)\sin(\theta)$$

This equations are ablicable on the three expected cases







Subcase =>

To adabt the equation On the three cases we add to C a cofficent d to detect direction of the motor by setting it in the code

$$C = d \times r \frac{n}{N} \times 2\pi$$

$\boxed{d \text{ can be } \pm 1}$

if $c_1 \simeq c_2$ meaning it's moving in straight line

$$X_{robot} = X_{in} + \frac{c_1+c_2}{2}\cos(\theta_{robot})$$

$$Y_{robot} = y_{in} + \frac{c_1+c_2}{2}\sin(\theta_{robot})$$

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